



Modular RICH Simulation – Applied Cuts on Photon Hits

Ping

12-07-2015



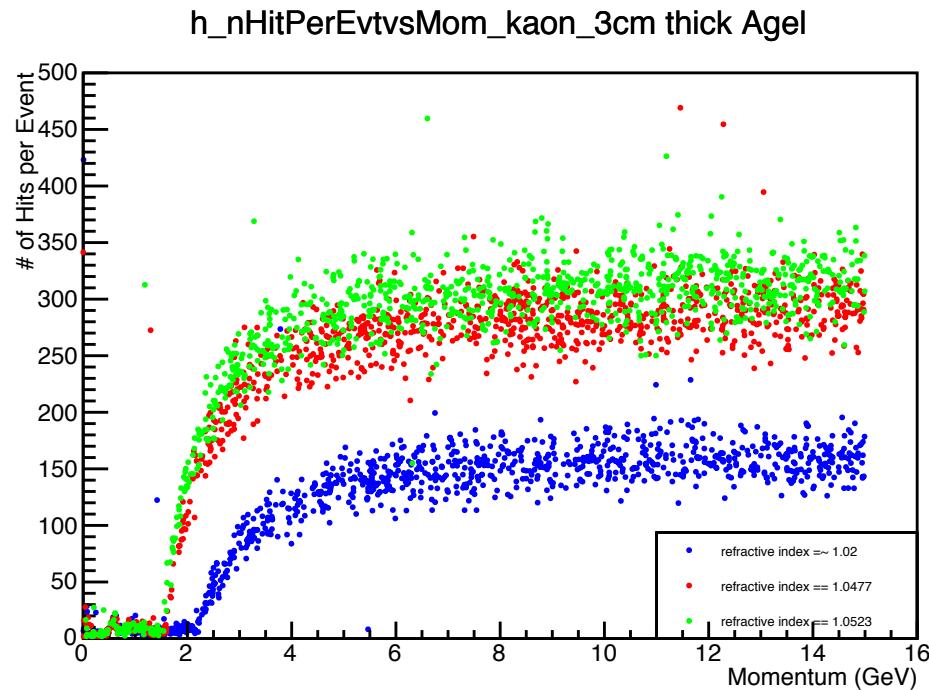
In Last Update

In last update, we compared

- Number of Hit per Event vs. Momentum
- Ring Radius vs. Momentum

with different aerogel refractive index, and
different aerogel thickness

- However, number of Hits per event includes all species of particle (no pid cut)
- Therefore, we re-analyzed the simulation result to get **Number of Photon Hits per events VS. momentum** (see next slide)



Number of Hit per Event vs. Momentum
plot from last update

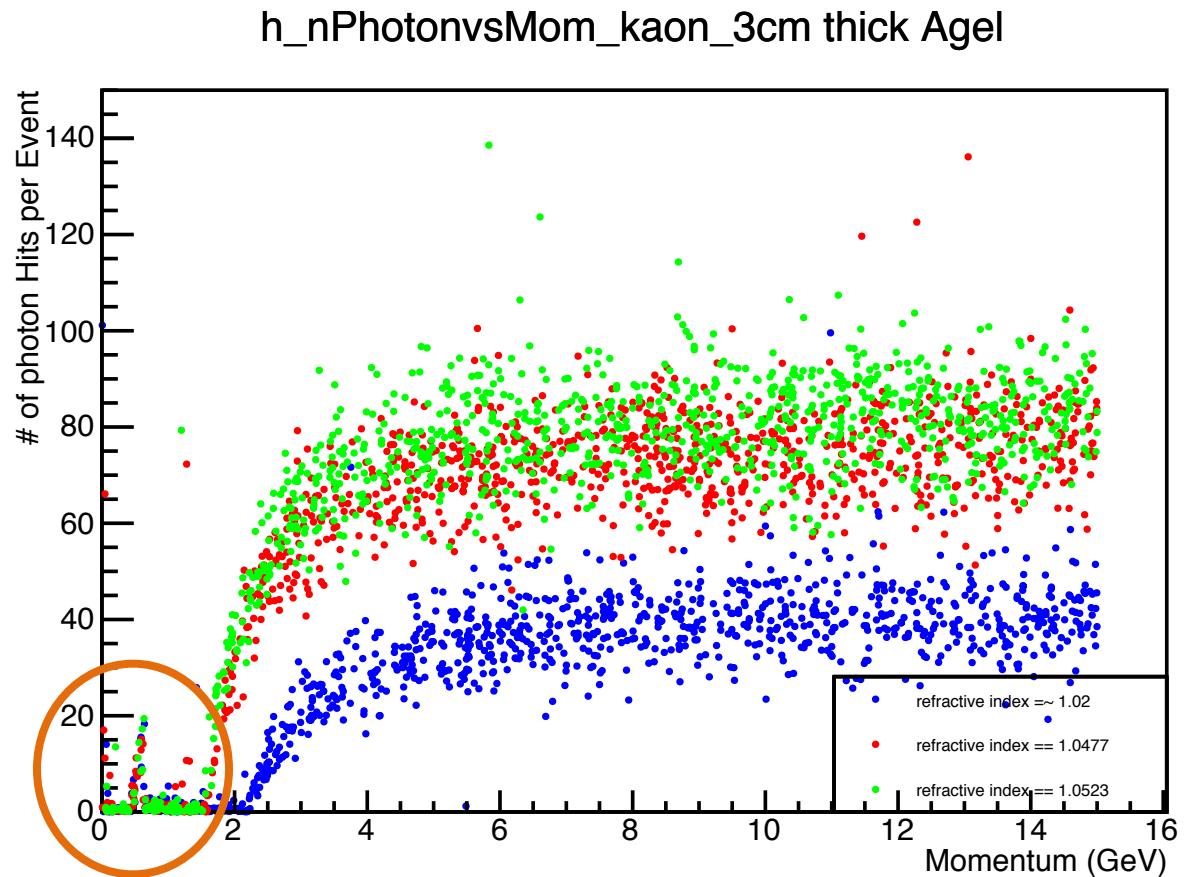
Strange Peak

What we expect

- Smooth curve
- Threshold momentum

However

- Two peaks appear in low momentum (<2 GeV, if launching kaon-) region
- ? Which one is the threshold momentum?





Simulation Setup

- Aerogel
 - 3 cm thick
 - Refractive index=1.05
- 10000 events
- Particles
 - Pion- in momentum range: 0-1 GeV
 - Kaon- in momentum range: 0-3 GeV



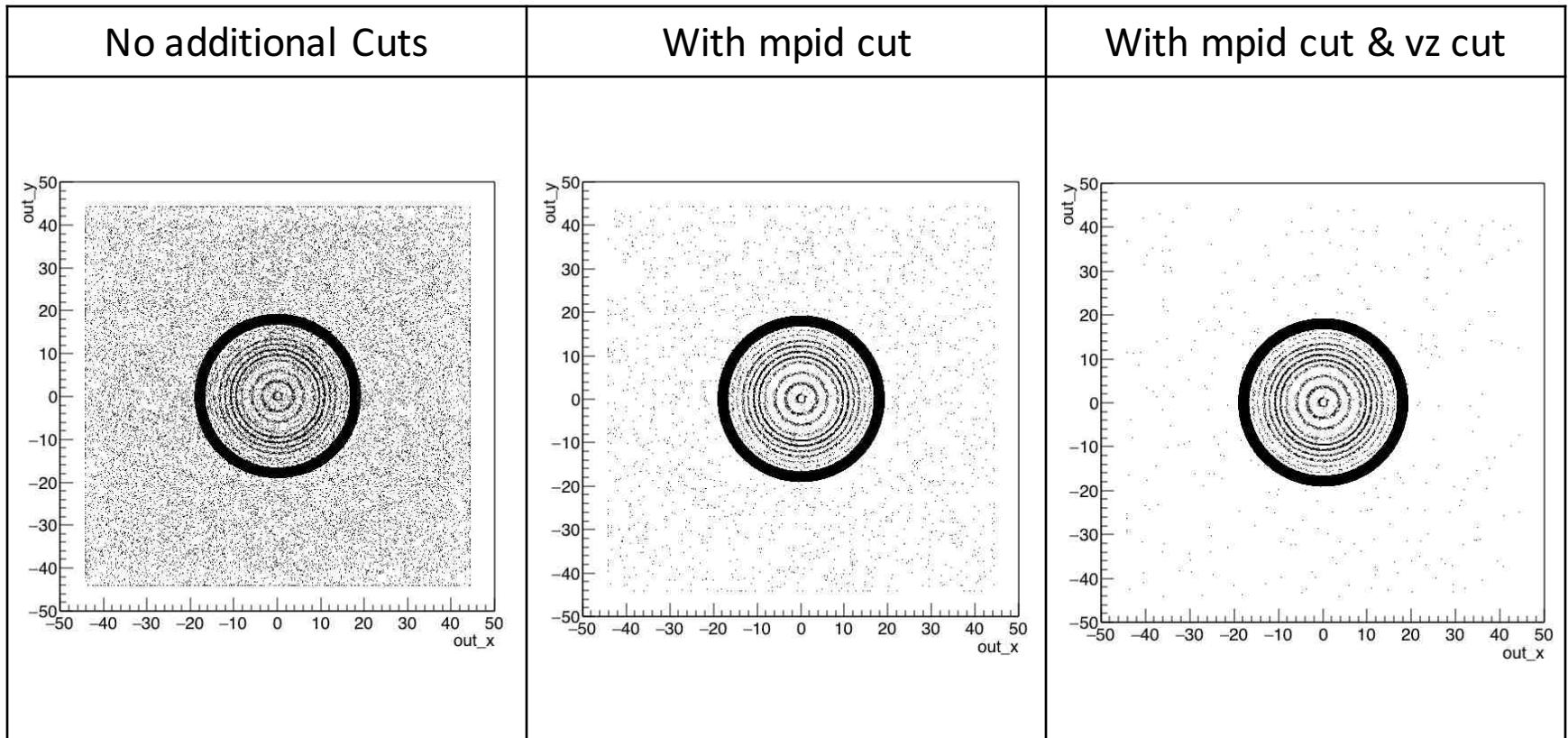
Data Analysis

- Basic cuts to extract **photon hits**
 - Position cut: hit on photonsensor
 - Particle species cut: photon
 - Momentum cut: $p_z > 0$
- Additional cut to extract **Cherenkov photons** from all photon hits
 - Mother particle=Pion- / Kaon-
 - Vertext cut: $55.5 \leq v_z \leq 86.$ photons that were generated inside aerogel



Hits on Photonsensor

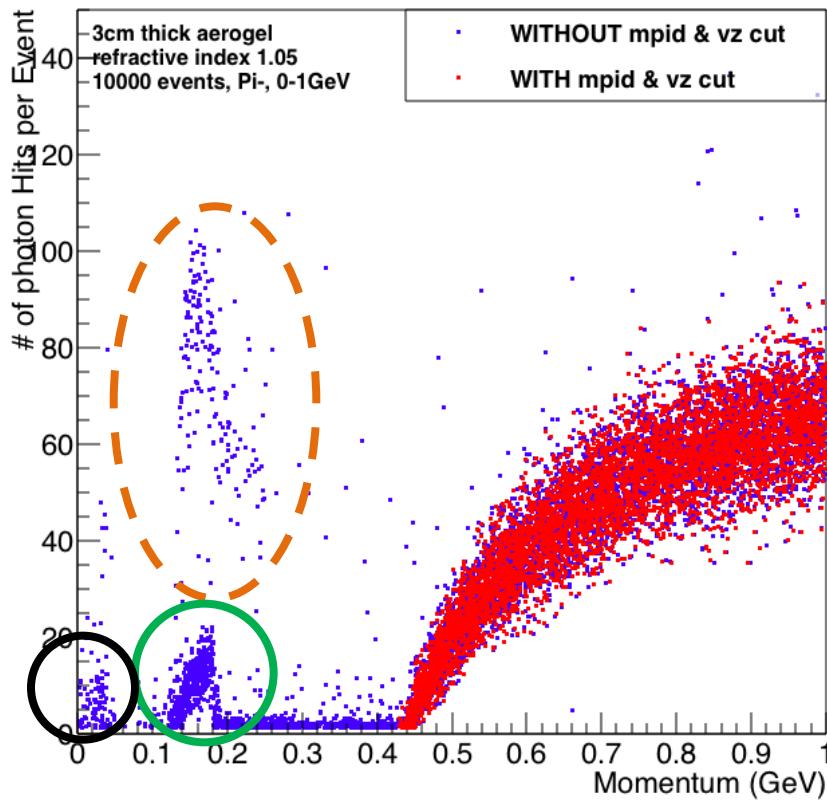
mu-, 9 GeV (fixed momentum)



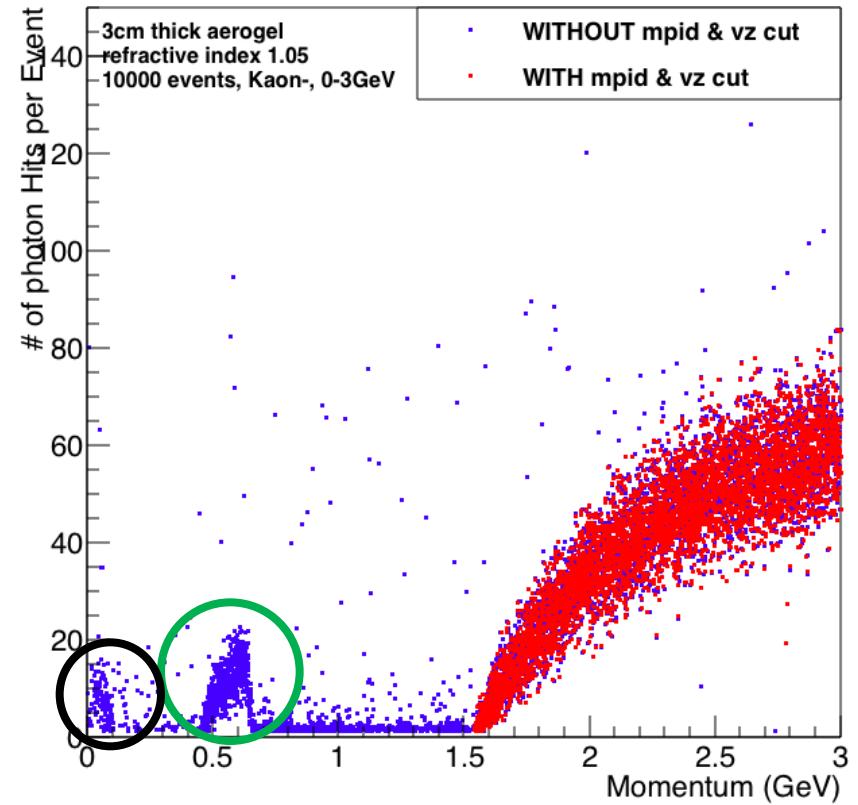
Visual presentation of how mother pid and vertex cut make a difference on reducing background

of Photon Hits on Photonsensor

Pion-, 0-1 GeV

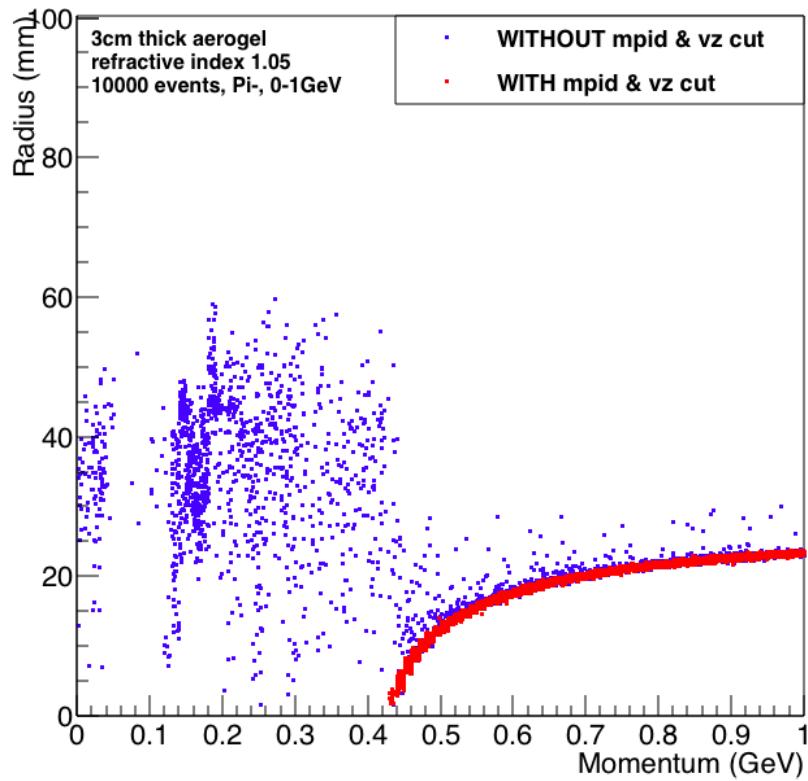


Kaon, 0-3 GeV

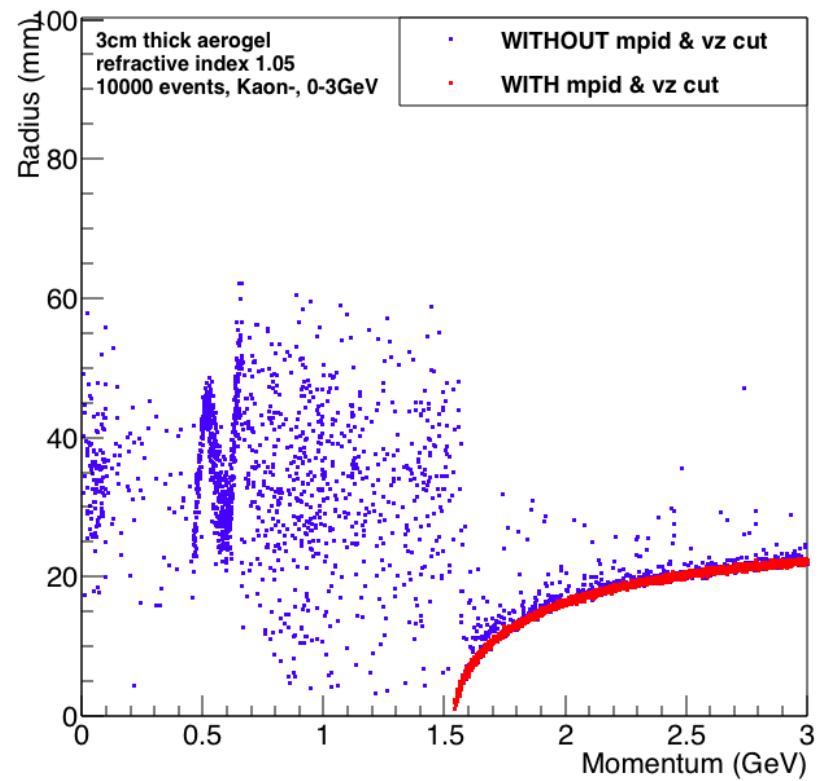


Cherenkov Ring Radius VS. Momentum

Pion-, 0-1 GeV



Kaon-, 0-3 GeV



Backgrounds from the above plots have similar features



Origin of Background Photon Hits

- Mother particles
 1. Electrons
 2. Muon-
 3. Proton
- Vertex of mother particles
 - Inside and outside aerogel



Summary

- Vertex cut and mother particle id cut help extract Cherenkov photons
- Background hits are from secondary charged particles (from ionization?)
- Questions
 - A sharp peak occurs in Number of Photon hits VS. Momentum plot if launching pion-
 - Pattern of the background (Cherenkov radiation inside Fresnel lens?)



Next

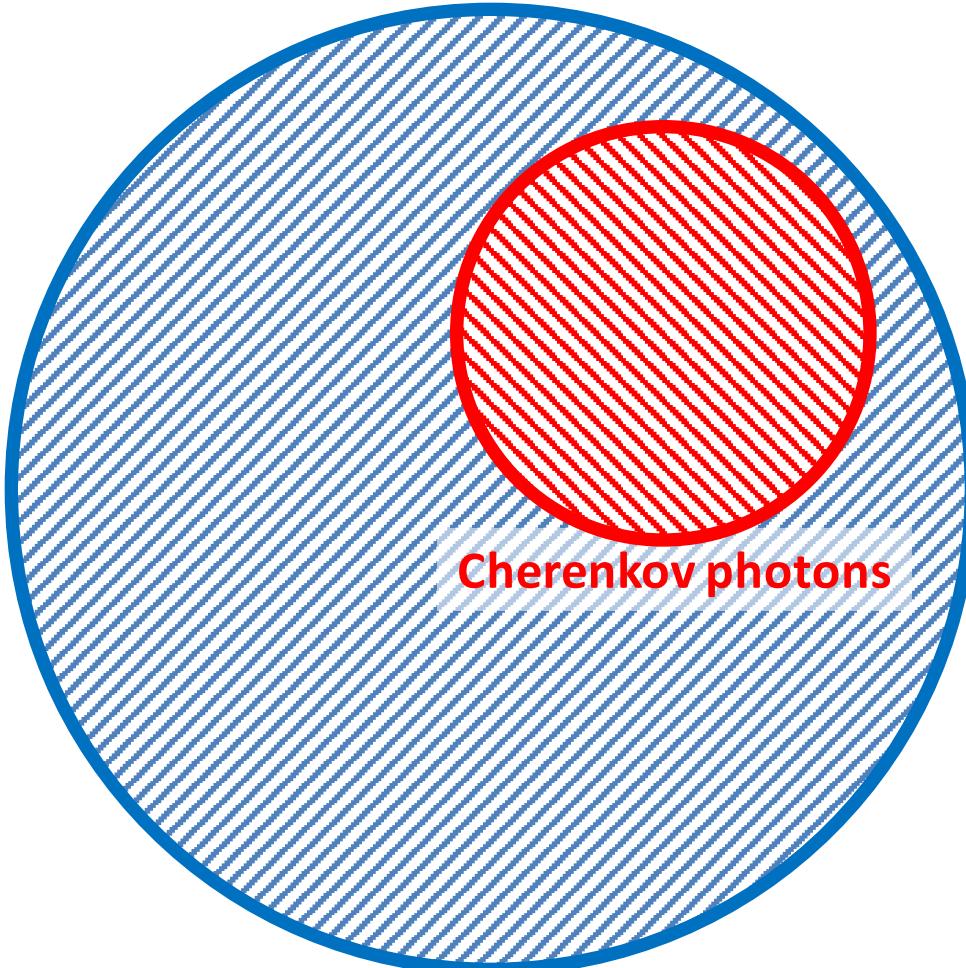
- Low momentum region background study
 - Redo simulation without Fresnel lens
 - Check energy spectrum of background photon
 - If it is out of the sensitive spectrum of photonsensor, it is ignorable
- **Likelihood Analysis**



Back Up



Data Analysis



All photon hits = background photons + Cherenkov photons